

A keep-it-simple guide to **Building Your Own Weather Station**

By Ken Reitz KS4ZR

Weather and radio have been a natural combination since the dawn of the wireless age. In the earliest part of this century weather reports were routine traffic traded between ships and shore stations. Hobbyists tuning in were the first to know when bad weather was on the way.

Today a national network of radio stations peppers the whole country for the sole purpose of disseminating weather information to the public. Billions of dollars a year trade hands in the field of weather related electronics. With the availability of The Weather Channel, NOAA Weather Radio and the Internet, more and more Americans are becoming interested in meteorology.

Setting Up Your Own Weather Station

Until recently, having sophisticated weather instruments that not only recorded daily weather statistics but could chart them in a customized data base, was reserved only for government and educational institutions. The rapid development of computer technology has made it possible for individuals to have their own dream weather station for less than the price of a good scanner radio.

These systems are widely available from many mail order catalog companies, including Radio Shack (see chart 1) and it's a good idea to shop for price. There may be as much as \$200 difference between nearly identical systems. Look to discount electronic catalogs for good deals, but pay attention to shipping fees and what's not specifically included.

Still, you don't have to invest a lot of money to have a very useful home weather station. Most hardware and discount stores sell inexpensive "weather stations" which consist typically of three analog gauges indicating temperature, barometric pressure and relative humidity (see photo). These units cost around \$20-30. While not weather service grade, they are useful for home purposes.

These units are shipped with the barometer uncalibrated. To calibrate your barometer call your local airport and get the current official barometric pressure reading (they may call it the altimeter reading). There is an adjustment on the back of the barometer which may be turned by hand to make the needle read the proper pressure. Once that's set it's ready to operate.

When you take a reading tap the glass with your finger to make sure it's reading the current pressure. Look for a barometer with a resettable pointer. This is a needle on the inside of the glass which is turned freely by a knob on the front of the gauge. When you line up the pointer with the current reading, the pointer stays where you set it while the barometer rises or falls. On your next reading you'll be able to see if the pressure is going up or down relative to where pointer was. Now reset the pointer by lining it up with the new reading.

It's good practice to recalibrate your barometer in the summer and in the winter to be as accurate as possible. It's particularly important to recalibrate it when a tropical system is headed your way. If you're a ham and you need to give barometric readings to a hurricane watch net, you must have a recently calibrated barometer or your information is useless.



Inexpensive simplicity. With this weather station I can read barometric pressure; current temperature; yesterday's high and this morning's low. Don't forget to calibrate your barometer with the one at your local airport.

The cheapest item you can buy for your weather station is a rain gauge. Every department and hardware store sells them, typically under \$5. They might not be as accurate as those at the National Weather Service (NWS), but they will give you an adequate reading. Place your rain gauge in the open, away from sheltering building and trees. Empty and record the results after every rainfall. For measuring snow, use a yard stick and take measurements immediately after the snow storm subsides. Measure at least three separate locations in an open, unprotected area and determine the average of the three for your "official" measurement.

The next cheapest item you'll buy for your weather station is a digital indoor/outdoor minimum/maximum reading thermometer. Once again the micro chip comes to the rescue and makes possible an inexpensive but very accurate weather instrument. Radio Shack has such a thermometer which it routinely discounts in its sales catalogs for around \$15. Wireless remote reading thermometers cost roughly twice that. Just remember when you're installing it to put the sensor out of direct view of the sun.

Wind Speed and Direction

A wind speed indicator, or anemometer, and a wind direction indicator are useful weather instruments to have at home. The most important is the wind direction indicator. If you're familiar with the normal wind patterns at your location you can make your own local forecasts by watching the barometer and wind direction. Measuring wind speed is more fun than important.

The cheapest and most effective wind direction device is the old fashioned windsock. A common sight at all airports, they are typically a long nylon cloth tube fixed at one end to a hoop which is hung by a harness on a post in the ground. The wind fills the windsock and rotates it to show wind direction. Many discount stores sell colorful windsocks in the flag and banner department. A good one will last years and typically cost \$10-20. The cheapest alternative is to take a few strips of plastic surveyor's tape about 4' long and tack them to the top of a six foot 2 x 4



stuck in the ground. The fluttering strips will show you where the wind's coming from.

Learning to read the movement of the windsock can turn it into a relative wind speed indicator as well. But, whether a wind is 10-15 mph or 15-20 mph isn't as relevant as knowing from which direction the wind is blowing.

There are several designs for building your own anemometers, two of which are listed in chart 4. Fair Radio Sales (listed in the Catalog Companies section of Chart 1), sells the dc motor and voltmeter required for the project and has a schematic in their catalog for building an anemometer. The key with this type of anemometer is that the motor must have smooth bearings that turn easily. Cheap motors will typically have sleeve bearings which will not work as well.

That's the easy part. Building the wind cups to drive the motor may prove a lot more difficult. I've used everything from metal ladles with the handles cut off, to plastic tablespoons. It's a great place to be creative and you can while away weeks trying to come up with a design which won't take a hurricane to actually move!

CHART 1: RESOURCES

Electronic Weather Station Manufacturers

Davis Instruments

3465 Diablo Avenue, Hayward, CA 94545-2778; 800-678-3669

www.davisnet.com

Peet Bros. Co., Inc.

1308 Doris Avenue, Ocean, NJ 97712; 800-872-7338

www.peetbros.com

Oregon Scientific, Inc.

18383 SW Boone's Ferry Road, Portland, OR 97224; 800-853-8883

www.oregonscientific.com

Catalog Companies

Wind & Weather

The Albion Street Water Tower

P.O. Box 3230, Mendocino, CA 95460; 800-922-9463

www.windandweather.com

Professional and consumer grade weather instruments and many other weather related items.

Fair Radio Sales Co.

P.O. Box 1105, Lima, OH 45802; 419-223-2196

www.fairradio.com

Electronic surplus. Has dc motor and voltmeter for wind speed indicator.

Damark International

7101 Winnetka Avenue N., Minneapolis, MN 55440-9437; 800-827-6767

www.damark.com

Discount catalog company often sells brand name electronic weather stations at deeply discounted prices.

Weather Facsimile Program and Modem

Tigertronics, Inc.

P.O. Box 5210, Grants Pass, OR 97527; 800-822-9722

www.tigertronics.com

With your instruments in place you can easily calculate the wind chill (winter) or heat index (summer) using charts 2 and 3. For an accurate reading you'll have to be able to read the outside relative humidity and be able to estimate wind speed.

Eyes in the Sky

Using home electronics to capture weather satellite imagery used to provide primitive results at best. Unless you were using very expensive professional equipment or had the skill to "homebrew" your own receiving gear, grainy facsimile reproductions were the best you could expect. Now, with the combination of sensitive receiving equipment and top grade consumer computers with laser printers, professional reproductions in your own home are typical.

Again, many companies make outstanding consumer weather satellite reception equipment all of which is readily available. And, if you shop

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HOW YOU CAN HELP YOUR COMMUNITY: JOIN SKYWARN!

The public safety and welfare of each community entails jobs we can all do. The National Weather Service provides a valuable public service by training interested citizens in the skills necessary to be useful in the event of a weather emergency. Called the SkyWarn program, training classes usually start before the beginning of the severe weather season in the spring.



While many SkyWarn members are amateur radio operators, it's not a requirement. All you need is an interest in weather and a desire to know more. Those who are hams can participate in other related activities such as the Amateur Radio Emergency Service (ARES) which often work closely with the SkyWarn program in establishing an emergency communications service in the event that weather disrupts normal communications modes.

Some SkyWarn groups establish an official SkyWarn amateur radio station which uses a call sign assigned by the FCC. The 2 x 3 call starts with WX followed by the call district number where the weather service office (WSO) is located (0-9) and the three letter NWS WSO identifier. So, if you hear the call sign WX4AKQ on the air, that means a severe weather condition exists in the eastern Virginia region served by the Wakefield, Virginia, WSO.

To learn more about SkyWarn's Severe Storm Spotters program, or to find out when classes will be held in your area, call your local NWS field office. If you have access to the Internet go to www.skywarn.net.

around, you'll pick up some good bargains. Still, these systems aren't cheap.

If buying and setting up your own weather satellite receiving system seems too expensive or difficult, similar results can be had by using a very inexpensive modem and your current shortwave radio. Readily available programs allow you to tune in satellite imagery and weather charts transmitted by the NWS for ships at sea (see chart 4).

The cheapest way to access the most weather information is via the Internet. Forget the commercial sites; go right to the source of the information on NOAA's Interactive Weather Information Network (IWIN) at <http://iwin.nws.noaa.gov/iwin/main.html>. At this site



State Information via the Interactive Weather Information Network shows forecasts, data and watches, satellite and radar imagery, and current weather information at the local airport for any listed location.

you'll be given a choice of options depending on your computer's capabilities.

Once you have the graphics version you want, you will see a map of the U.S. on which various states may be in different colors depending on the types of weather advisories being issued at that moment. By clicking on your state you'll see your own IWIN page. You may want to book mark this page so that you can go directly to it when you need to have updated weather information for your region in a hurry.

Among the information options available are "Warnings and Advisories," "State and Zone Forecasts," satellite and radar imagery, and much more. The most interesting is the "Forecast Discussion" area. Here you'll be able to eavesdrop on the weather forecasters as they swap info and ideas about what's happening and what may be about to happen. The discussions are in text and each forecaster has his or her own style of writing. It's an excellent opportunity to get some insight into how daily and long term forecasts are made. You'll have to get used to reading their weather shorthand.

Get Started!

Once you get your minimum/maximum reading thermometer, barometer and rain gauge set up you should consider getting a small book in which you can make weather notes. I've kept an unofficial weather journal for the last seven years and have recorded record lows (-18 degrees F), highs (102 degrees F), barometric pressure (a high of 30.85 inches and a low of 29.25 inches), single rainfall (8" during remnants of Hurricane Fran), and single snowfall (15 inches). From my handwritten entries I can get monthly and yearly rainfall data, average temperature highs and lows, etc.

So, put your weather station together, sign up for a SkyWarn class (see sidebar) and you'll add a new and interesting facet to your radio hobby.

CHART 2: WIND CHILL

www.nws.noaa.gov/er/lwx/wxcalc/wndchill.htm

		Equivalent Temperature (°F)															
Wind Speed (mph)	Air Temp (°F)	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80
		35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40
5	5	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40
10	5	32	27	22	17	12	7	2	-3	-8	-13	-18	-23	-28	-33	-38	-43
15	5	28	23	18	13	8	3	-2	-7	-12	-17	-22	-27	-32	-37	-42	-47
20	5	24	19	14	9	4	-1	-6	-11	-16	-21	-26	-31	-36	-41	-46	-51
25	5	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50	-55
30	5	16	11	6	1	-4	-9	-14	-19	-24	-29	-34	-39	-44	-49	-54	-59
35	5	12	7	2	-3	-8	-13	-18	-23	-28	-33	-38	-43	-48	-53	-58	-63
40	5	8	3	-2	-7	-12	-17	-22	-27	-32	-37	-42	-47	-52	-57	-62	-67
45	5	4	-1	-6	-11	-16	-21	-26	-31	-36	-41	-46	-51	-56	-61	-66	-71
50	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50	-55	-60	-65	-70	-75
55	5	-4	-9	-14	-19	-24	-29	-34	-39	-44	-49	-54	-59	-64	-69	-74	-79
60	5	-8	-13	-18	-23	-28	-33	-38	-43	-48	-53	-58	-63	-68	-73	-78	-83
65	5	-12	-17	-22	-27	-32	-37	-42	-47	-52	-57	-62	-67	-72	-77	-82	-87
70	5	-16	-21	-26	-31	-36	-41	-46	-51	-56	-61	-66	-71	-76	-81	-86	-91
75	5	-20	-25	-30	-35	-40	-45	-50	-55	-60	-65	-70	-75	-80	-85	-90	-95
80	5	-24	-29	-34	-39	-44	-49	-54	-59	-64	-69	-74	-79	-84	-89	-94	-99
85	5	-28	-33	-38	-43	-48	-53	-58	-63	-68	-73	-78	-83	-88	-93	-98	-103
90	5	-32	-37	-42	-47	-52	-57	-62	-67	-72	-77	-82	-87	-92	-97	-102	-107
95	5	-36	-41	-46	-51	-56	-61	-66	-71	-76	-81	-86	-91	-96	-101	-106	-111
100	5	-40	-45	-50	-55	-60	-65	-70	-75	-80	-85	-90	-95	-100	-105	-110	-115

CHART 3: HEAT INDEX

www.nws.noaa.gov/er/lwx/wxcalc/heatindx.htm

		Heat Index (°F)															
Relative Humidity (%)	Air Temp (°F)	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200
		50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200
50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
60	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
70	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
80	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
90	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
100	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
110	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
120	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
130	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
140	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
150	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
160	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
170	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
180	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
190	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
200	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50

CHART 4: FURTHER READING

Articles on home-brewing weather instruments.

Popular Electronics' Electronics Hobbyists Handbook (Fall 1994) *

"Portable Barometer" By Anthony Caristi. Pages 51-56

"Relative Humidity Gauge" By Anthony Caristi. Pages 84-88, 106

"Build An Anemometer" By Bob Simcox. Pages 98-101

Popular Electronics (February 1996) *

Think Tank "Weather Circuits" By John Vacono. Pages 67-69

Has schematics on building an anemometer and wind vane.

*Gernsback Publications, Inc., 500-B Bi-County Blvd., Farmingdale, NY 11735, 516-293-3000

Monitoring Times:

"Cheap Earth Thrills: a \$30 Fax Program and Interface" By John Catalano (January, 1994 pages 96-97)

"HF Fax on a Shoestring" By Brian Webb (August, 1996 pages 13-15)

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